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DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR SWEEP OSCILLATOR, HEWLETT-PACKARD MODELS 8350A, 8350B, 8350/E05, AND PLUG-IN HEWLETT-PACKARD, MODEL 83525A

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Headquarters, Department of the Army, Washington, DC
10 January 1985

REPORTING OF ERRORS

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SECTION I

IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Sweep Oscillator, Hewlett-Packard, Models 8350A, 8350B, 8350/E05, and Plug-In, Hewlett-Packard, Model 83525A. The manufacturer's manuals were used as the prime data sources in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. None.

b. Time and Technique. The time required for this calibration is approximately 6 hours, using the microwave technique.

2. DA Form 2416 (Calibration Data Card)

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25-1. DA Form 2416 must be annotated in accordance with TB 750-25-1 for each calibration performed.

b. Adjustments to be reported on DA Form 2416 are designated (R) at the end of the sentence in which they appear. When adjustments are in tables, the (R) follows the designated adjustment. Report only those adjustments made and designated with (R).

3. Calibration Description. TI parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications
Power requirements	100, 120, 220, or 240 V, +5% -10%, 50 to 60 Hz
Tuning voltage	Range: 0, 5, and 10 V dc Accuracy: ±0.4%
Frequency	Range: 0.01 to 8.4 GHz Accuracy: ±5 MHz, 0.01 to 2 GHz ±15 MHz, 2 to 8.4 GHz
Output amplitude	Range: -2.0 to +13.0 dBm Accuracy: ±1.5 dB
Frequency stability	Range: 0.01 to 8.4 GHz Accuracy: ±20 kHz at 10% line change
AM on/off ratio	Range: 1 GHz Power: +13 dBm

SECTION II

EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Set AN/GSM-287. Alternate items may be used by the calibrating activity when the equipment listed in table 2 is not available. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-one ratio between the standard and TI.

5. Accessories Required. The accessories listed in table 3 are issued as indicated in paragraph 4 above and are used in this calibration procedure. When necessary, these items may be substituted by equivalent items, unless specifically prohibited.

Table 2. Minimum Specifications of Equipment Required

Item	Common name	Minimum use specifications	Manufacturer and model (part number)
A1	AUTOTRANSFORMER	Range: 115 V ac Accuracy: ±1%	General Radio, Model W10MT3AS3 or Ridge, Model 9020F (7910809)
A2	DIFFERENTIAL VOLTMETER	Range: -40 to +20 V dc Accuracy: ±.01%	John Fluke, Model 887AB/AN (887AB/AN)
A3	DIGITAL VOLTMETER	Range: -20 to +20 V dc Accuracy: ±.025%	Hewlett-Packard, Model 3490AOPT060 (3490AOPT060)
A4	FREQUENCY COUNTER	Range: .01 to 8.4 GHz Accuracy: ±.0625%	EIP, Model 351D (351D)
A5	FREQUENCY COUNTER	Range: 10 µs to 1 s Accuracy: ±.05%	Hewlett-Packard, Model 5345A (MIS-28754/1 Type 1) w/5355A and K87-59992A
A6	FREQUENCY METER (LOW RANGE)	Range: .96 to 4.0 GHz Accuracy: ±0.17%	Hewlett-Packard, Model 536A (7910718)
A7	FREQUENCY METER (HIGH RANGE)	Range: 4.0 to 8.4 GHz Accuracy: ±0.17%	Hewlett-Packard, Model 537A (7910718-2)
A8	OSCILLOSCOPE	Range: Dc to 100 MHz Vertical sensitivity: ≤5 mV/div Horizontal sweep rate: ≤0.1 µs/div	Tektronix, Type R5440 (MIS-28706/1 Type 1) w/5A48 (MIS-28706/3) and 5B42 (MIS-28706/4)

Table 2. Minimum Specifications of Equipment Required - Continued

Item	Common name	Minimum use specifications	Manufacturer and model (part number)
A9	POWER METER	Range: -20 to +20 dBm Accuracy: ±1.5 dBm	Hewlett-Packard, Model E12-432A (MIS-30525) w/thermistor mount, Hewlett-Packard, Model 478A (9975991) or 8478A
A10	SPECTRUM ANALYZER	Range: 0.01 to 8.4 GHz	Tektronix, Type R491 (MIS-10218)

Table 3. Accessories Required

Item	Common name	Description (part number)
B1	ADAPTER	N plug to BNC jack (10519457) (UG201A/U)
B2	ADAPTER	N jack to N jack (10519455)
B3	ADAPTER	Type N-T (UG-107B/U)
B4	ATTENUATOR	N plug to N jack (777C-3 dB)
B5	ATTENUATOR	N plug to N jack (777C-10 dB)
B6	ATTENUATOR	N plug to N jack (777C-20 dB)
B7	CABLE[1]	30-in., RG-58/U; double banana plug terminations (7907470)
B8	CABLE[2]	24-in., RG-58/U; BNC to BNC (10519141)
B9	CABLE[2]	18-in., RG-9A/U; N plug terminations (10519072)
B10	CABLE	36-in., RG-58/U; BNC plug to double banana plug terminations (7907471)
B11	CLIP	Single banana jack to alligator clip (black) (SMI 301B)
B12	CRYSTAL DETECTOR	Hewlett-Packard, Model 423A
B13	LEAD[1]	32-in., single banana plug to test hook (red) (7915941-1)
B14	POWER SPLITTER	Weinschel, Model 1870A (1870A)

[1]Two required.
[2]Three required.

SECTION III

CALIBRATION PROCESS FOR

HEWLETT-PACKARD, MODELS 8350A AND 8350B

6. Preliminary Instructions

a. The instructions outlined in paragraphs 6 and 7 are preparatory to the calibration process. Personnel should become familiar with the applicable sections before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name and item identification number as listed in tables 2 and 3. For the identification of equipment referenced by item numbers prefixed with A, see table 2, and for prefix B, see table 3.

WARNING

HIGH VOLTAGE is used or exposed during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions.

NOTE

Unless otherwise specified, verify the result of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in the manufacturer's manuals for this TI.

NOTE

When indications specified in paragraph 8 are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraph 8. Do not perform power supply check if all other parameters are within tolerance.

NOTE

Unless otherwise specified, all controls and control settings refer to the TI.

NOTE

Plug-in must be removed during following performance checks.

7. Equipment Setup. Connect TI to a 115-V ac source and set LINE switch to ON and allow equipment to warm up for 30 minutes.

8. Tuning Voltage

a. Performance Check

NOTE

If an out-of-tolerance condition is found during any performance check in (1) through (4) below, perform **b** below.

(1) Connect differential voltmeter (A2) negative terminal to A4TP7 (fig. 1) and positive terminal to A4TP11 (fig. 1), using two leads (B13).

(2) Press CW, 0, and MHz pushbuttons. Differential voltmeter indication will be between -0.004 and +0.004 V dc.

(3) Press 5 and GHz pushbuttons. Differential voltmeter indication will be between 4.996 and 5.004 V dc.

(4) Press 1, 0, and GHz pushbuttons. Differential voltmeter indication will be between 9.996 and 10.004 V dc.

b. Adjustments

(1) Connect differential voltmeter negative terminal to A4TP7 and positive terminal to A4TP14 (fig. 1), using two leads (B13). Adjust A4R59 (fig. 1) for a 10.0000-V dc indication on differential voltmeter (R).

(2) Remove differential voltmeter from TI and connect frequency counter (A5) to POS Z BLANK (rear panel), using cable (B8). Set up frequency counter for time interval measurement.

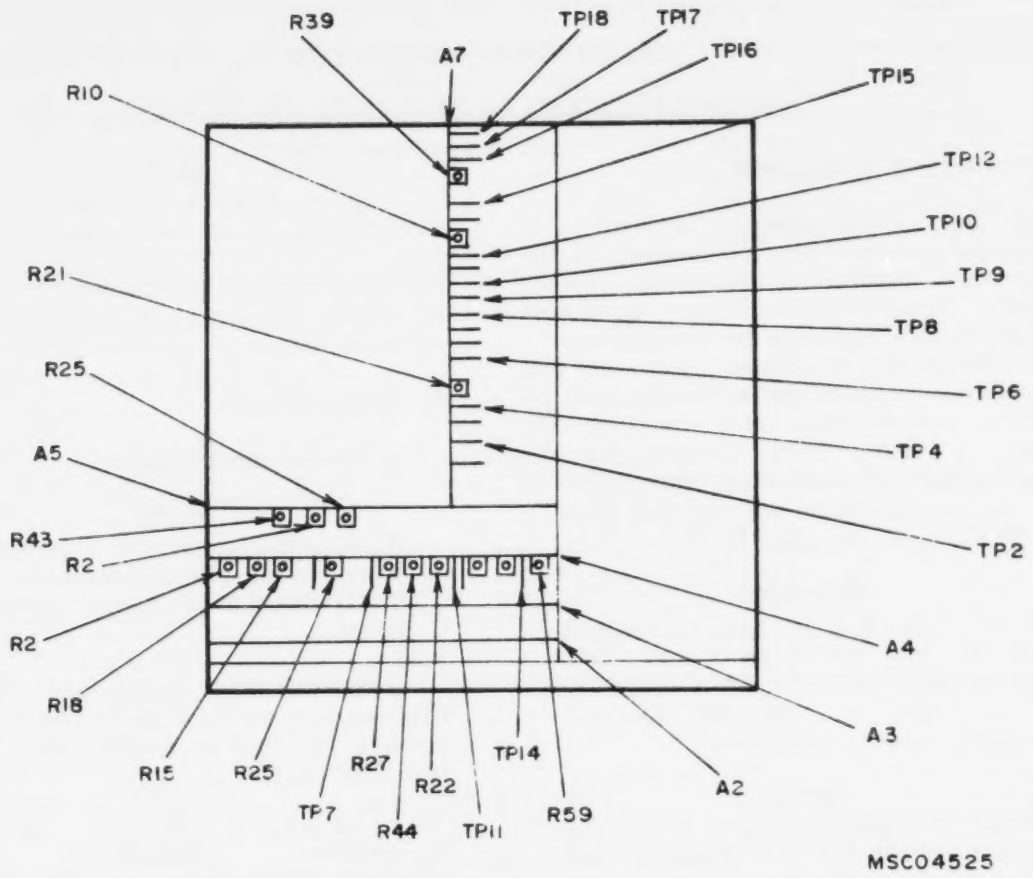

Figure 1. Test instrument mainframe - adjustment locations.

(3) Press INSTR PRESET, SWEEP TIME, 1, 0, and MS pushbuttons, and adjust A5R2 (fig. 1) for a 10.000-ms indication on frequency counter.

(4) Press INSTR PRESET, SWEEP TIME, 1, and S pushbuttons, adjust A5R25 (fig. 1) for a 1000-ms indication on frequency counter (R).

(5) Remove frequency counter from TI and connect differential voltmeter negative terminal to A4TP7 and positive terminal to A4TP11 (fig. 1), using two leads (B13).

(6) Press INSTR PRESET pushbutton.

(7) Press SHIFT, 0, 0, M1, 2, 0, 1, 6, M2, GHz, and 9 pushbuttons. FREQUENCY/TIME display will indicate C9.

(8) Press M1, 2, 0, 1, 7, M2, BK SP, and dBm pushbuttons. FREQUENCY/TIME display will indicate FE. Adjust A5R43 (fig. 1) for a 10-V dc indication on differential voltmeter (R).

(9) Press INSTR PRESET, CW, -, 2, 0, 0, and MHz pushbuttons.

(10) Press SHIFT, 0, 0, M1, 3, 0, 0, 0, M2, 0, and 1 pushbuttons. FREQUENCY/TIME display will indicate 01. Adjust A4R44 (fig. 1) for a -.20508-V dc indication on differential voltmeter (R).

(11) Press BK SP, pushbutton twice. FREQUENCY/TIME display will indicate FF. Adjust A4R22 (fig. 1) for a -.19492-V dc indication on differential voltmeter (R).

(12) Press 8 and 0 pushbuttons. FREQUENCY/TIME display will indicate

80. Differential voltmeter will indicate -.20000 V dc.

(13) Press INSTR PRESET, CW, 1, 0, ., 2 and GHz pushbuttons. Adjust A4R27 (fig. 1) for a 10.2000-V dc indication on differential voltmeter (R).

(14) Press INSTR PRESET, ΔF, 1, 0, ., 4, GHz, SWEEP MAN, 1, 0, ., 2, and GHz pushbuttons. Adjust A4R25 (fig. 1) for a 10.2000-V dc indication on differential voltmeter (R).

(15) Press -, 2, 0, 0, and MHz, pushbuttons. Adjust A4R2 (fig. 1) for a -.2000-V dc indication on differential voltmeter (R).

(16) Press ΔF, 0, and GHz pushbuttons. If differential voltmeter does not indicate 5.00000 V dc, press VERNIER pushbutton, and adjust CW VERNIER control until differential voltmeter indicates 5.00000 V dc.

(17) Press ΔF, 1, ., 2, 9, 9, and GHz pushbuttons and adjust A4R15 (fig. 1) for a 4.35064-V dc indication on differential voltmeter (R).

(18) Press ΔF, 1, 6, 2, ., 4, and MHz pushbuttons and adjust A4R18 (fig. 1) for a 4.91883-V dc indication on differential voltmeter (R).

9. Power Supply

NOTE

Do not perform power supply checks if all other parameters are within tolerance.

a. Performance Check

(1) Connect differential voltmeter (A2) negative terminal to A7TP6 and positive terminal to A7TP15 (fig. 1) using two leads (B13). If differential voltmeter does not indicate between 19.990 and 20.010 V dc, perform b(1) below.

(2) Move negative lead to A7TP2 and positive lead to A7TP10 (fig. 1). If differential voltmeter does not indicate between -39.980 and -40.020 V dc, perform b(2) below.

(3) Move negative lead to A7TP4 and positive lead to A7TP12 (fig. 1). If differential voltmeter does not indicate between -9.995 and -10.005 V dc, perform b(3) below.

b. Adjustments

(1) Move negative lead to A7TP16 and positive lead to A7TP15 (fig. 1). Adjust A7R10 (fig. 1) for a 20.000-V dc indication on differential voltmeter (R).

(2) Move negative lead to A7TP18 and positive lead to A7TP17 (fig. 1). Adjust A7R39 (fig. 1) for a -40.000-V dc indication on differential voltmeter (R).

(3) Move negative lead to A7TP9 and positive lead to A7TP8 (fig. 1). Adjust A7R21 (fig. 1) for a -10.000-V dc indication on differential voltmeter (R).

10. Final Procedure

a. Deenergize and disconnect all equipment and reinstall protective cover on TI.

b. When all parameters are within tolerance, annotate and affix DA Label 80 (US Army Calibrated Instrument). When the TI receives limited or special calibration, annotate and affix DA Label 163 (US Army Limited or Special Calibration). When the TI cannot be adjusted within tolerance, repair the TI in accordance with the maintenance manual. When repair is delayed for any reason or the TI cannot be repaired with local resources, annotate and affix DA Form 2417 (US Army Calibration System Rejected Instrument) and inform the owner/user accordingly in accordance with TB 750-25-1.

SECTION IV

CALIBRATION PROCESS FOR

PLUG-IN HEWLETT-PACKARD, MODELS 83525A AND 8350/E05

11. Preliminary Instructions

a. The instructions outlined in paragraphs 11 and 12 are preparatory to the calibration process. Personnel should become familiar with the applicable sections before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name and item identification number as listed in tables 2 and 3. For the identification of equipment referenced by item numbers prefixed with A, see table 2, and for prefix B, see table 3.

WARNING

HIGH VOLTAGE is used or exposed during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions.

NOTE

Unless otherwise specified, verify the result of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in the manufacturer's manual for this TI.

NOTE

Unless otherwise specified, all controls and control settings refer to the TI.

12. Equipment Setup

NOTE

TI must be inserted into a calibrated Hewlett-Packard, Model 8350 mainframe.

a. Remove TI protective cover as required for adjustment.

b. Connect mainframe to autotransformer (A1).

c. Connect autotransformer to a 115-V ac source and adjust for 115 V output.

d. Set POWER switch to ON and allow at least 1 hour for equipment to warm up and stabilize.

13. Frequency Range and Accuracy

a. Performance Check

(1) Connect frequency counter (A4) to RF OUTPUT, using attenuator, cable, and adapter (B5, B8, and B1).

(2) Press pushbuttons as listed in (a) through (c) below:

(a) CW.
(b) DATA ENTRY for 1 GHz.
(c) RF output power ON/OFF to ON. If frequency counter does not display an indication between .995 and 1.005 GHz, perform b(1) through (3) below.

(3) Repeat technique of (2) above, for settings and indications listed in table 4. If frequency counter does not indicate within limits specified and adjustments were not performed in (2) above, perform b(1) through (3) below.

NOTE

If an out-of-tolerance is indicated in (4) through (19) below, perform b(4) through (32) below.

(4) Connect equipment as shown in figure 2.

(5) Press pushbuttons as listed in (a) through (g) below:

(a) INSTR PRESET.
(b) START.
(c) DATA ENTRY for 1 GHz.

Table 4. Frequency Range Accuracy

Test instrument		Frequency counter indications	
Frequency settings	Indications	Min	Max
10 MHz	10 MHz	5 MHz	15 MHz
2.00 GHz	2.000 GHz	1.995 GHz	2.005 GHz
2.1 GHz	2.100 GHz	2.085 GHz	2.115 GHz
6.0 GHz	6.000 GHz	5.985 GHz	6.015 GHz
8.4 GHz	8.400 GHz	8.385 GHz	8.415 GHz

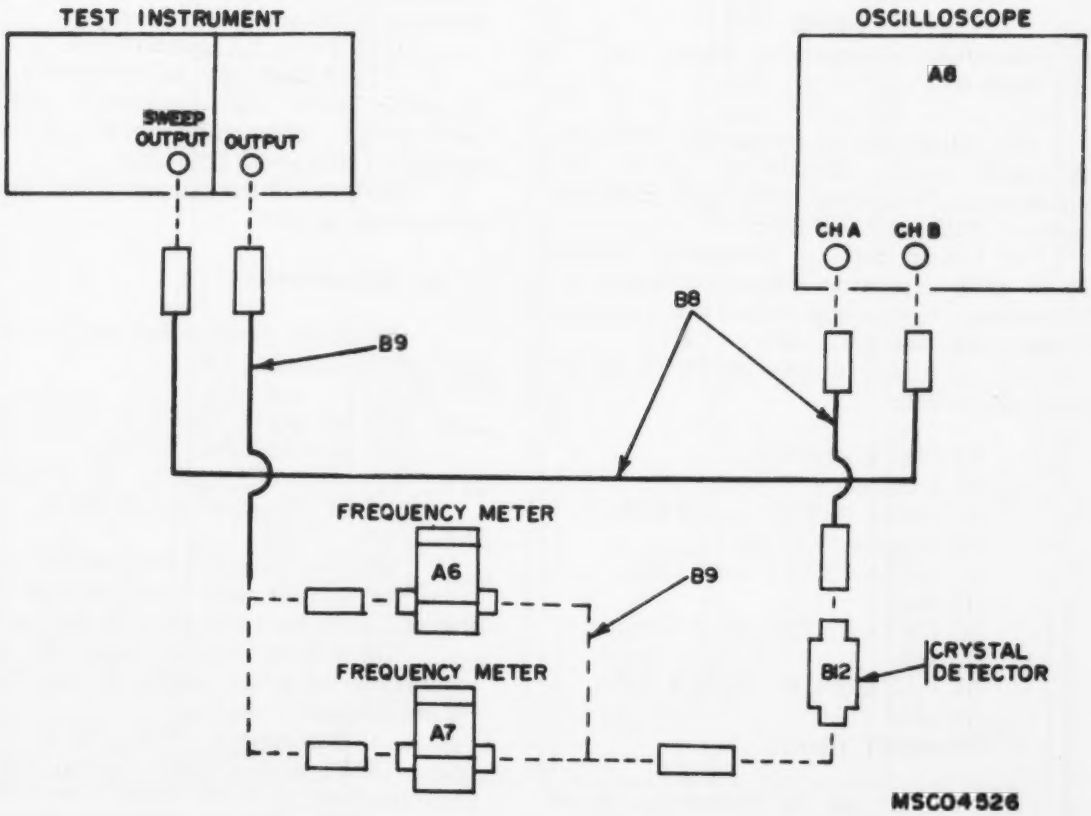

Figure 2. Swept frequency accuracy - equipment setup.

(d) Frequency STOP.
(e) DATA ENTRY for 2 GHz.
(f) SWEEP TIME.
(g) DATA ENTRY for 105 ms.

(6) Adjust pip of frequency meter (A6) to aline with start frequency notch on oscilloscope (A8). Frequency meter will indicate between 985 MHz and 1.015 GHz.

(7) Adjust pip of frequency meter to aline with stop frequency notch on oscilloscope. Frequency meter will indicate between 1.985 and 2.015 GHz.

(8) Press pushbuttons as listed in (a) through (d) below:

(a) Frequency START.
(b) DATA ENTRY for 2 GHz.
(c) Frequency STOP.
(d) DATA ENTRY for 8.4 GHz.

NOTE

Substitute frequency meter as required.

(9) Adjust pip of frequency meter to aline with start frequency notch on oscilloscope. Frequency meter will indicate between 1.980 and 2.020 GHz.

(10) Adjust pip of frequency meter (A7) to aline with stop frequency notch on oscilloscope. Frequency meter will indicate between 8.380 and 8.415 GHz.

(11) Press pushbuttons as listed in (a) through (k) below:

(a) INSTR PRESET.
(b) Frequency START.
(c) DATA ENTRY for 10 MHz.
(d) Frequency STOP.
(e) DATA ENTRY for 2 GHz.
(f) M1.
(g) DATA ENTRY for 1 GHz.
(h) M2.
(i) DATA ENTRY for 1.8 GHz.
(j) M1.
(k) AMPTD MKR.

(12) Adjust pip of frequency meter to aline with M1 frequency notch on oscilloscope. Frequency meter will indicate between 0.975 and 1.025 GHz.

(13) Press M2 pushbutton.

(14) Adjust pip of frequency meter to aline with M2 frequency notch on oscilloscope. Frequency meter will indicate between 1.775 and 1.825 GHz.

(15) Press pushbuttons as listed in (a) through (i) below:

(a) Frequency START.
(b) DATA ENTRY for 2 GHz.
(c) Frequency STOP.
(d) DATA ENTRY for 8.4 GHz.
(e) M1.
(f) DATA ENTRY for 2.5 GHz.
(g) M2.
(h) DATA ENTRY for 8.0 GHz.
(i) M1.

(16) Adjust pip of frequency meter to aline with M1 frequency notch on oscilloscope. Frequency meter will indicate between 2.448 and 2.552 GHz.

(17) Press M2 pushbuttons.

(18) Adjust pip of frequency meter to aline with M2 frequency notch on oscilloscope. Frequency meter will indicate between 7.948 and 8.052 GHz.

(19) Press RF output power ON/OFF pushbutton to OFF.

b. Adjustments

(1) Press pushbuttons as listed in (a) through (d) below:

(a) INSTR PRESET.
(b) Frequency STOP.
(c) DATA ENTRY for 2 GHz.
(d) Plug-in AMPTD MKR.

(2) Disconnect frequency counter from RF output and reconnect to A8TP1 (fig. 3), using lead and adapter (B13 and B1).

(3) Adjust A8C4 (fig. 3) for an indication between 49999750 to 50000250 Hz on frequency counter.

(4) Disconnect frequency counter from A8TP1 and connect digital voltmeter (A3) positive lead to A6TP3 and negative lead to A6TP5 (fig. 3), using two leads (B13). Adjust A6R21 (fig. 3) for a digital voltmeter indication from -9.999 to -10.001 V dc.

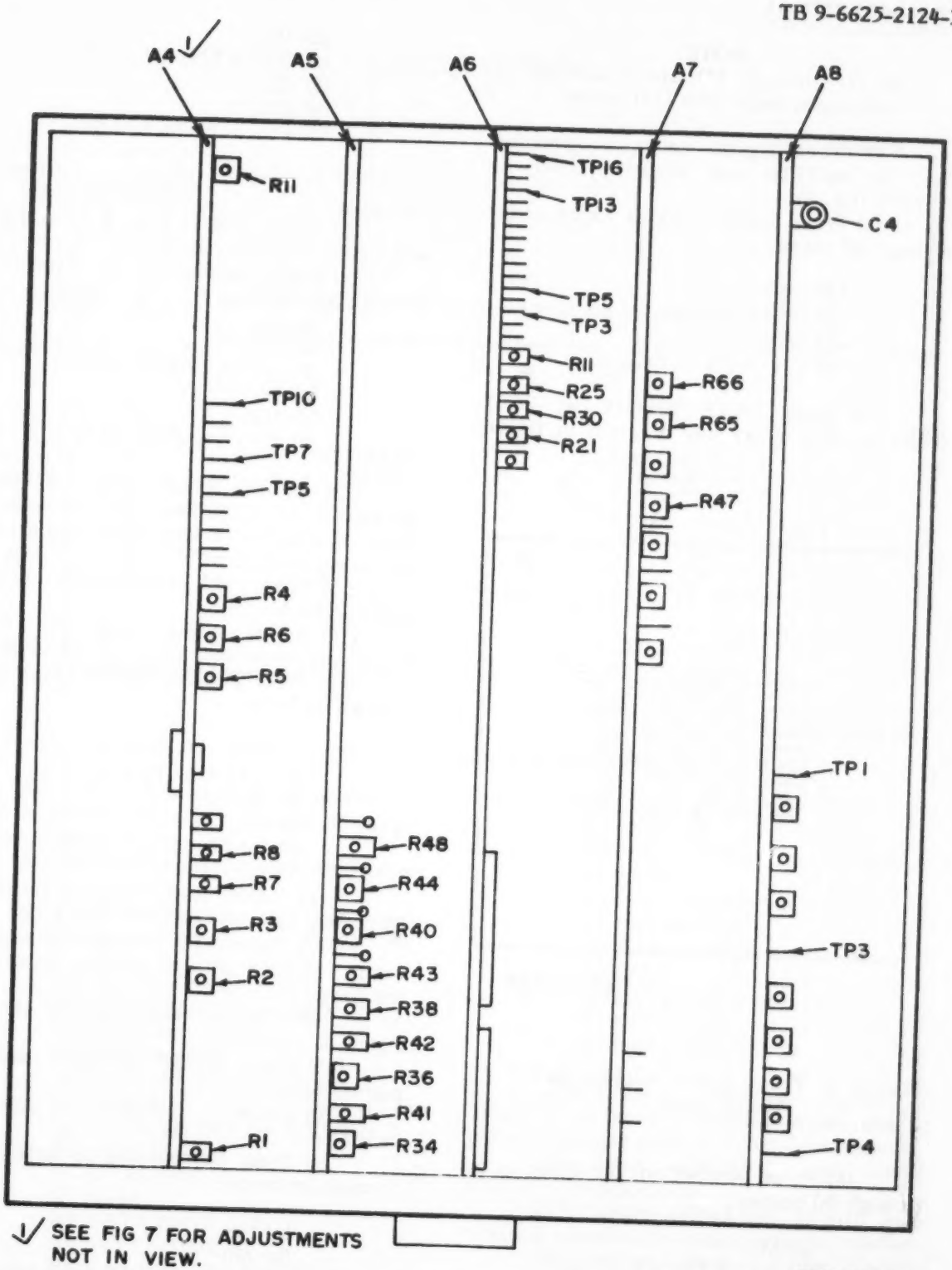

Figure 3. Plug-in - adjustment locations.

NOTE

If (1) through (3) above are in tolerance, begin with (18) below.

(5) Move digital voltmeter positive lead to A6TP16 and negative lead to A6TP13 (fig. 3).

(6) Press pushbuttons as listed in (a) through (d) below:

(a) CW.
(b) DATA ENTRY for 8.4 GHz.
(c) SHIFT.
(d) DATA ENTRY .....00.

(7) Make DATA ENTRY of 2C81 (refer to HEX entry key diagram in figure 4).

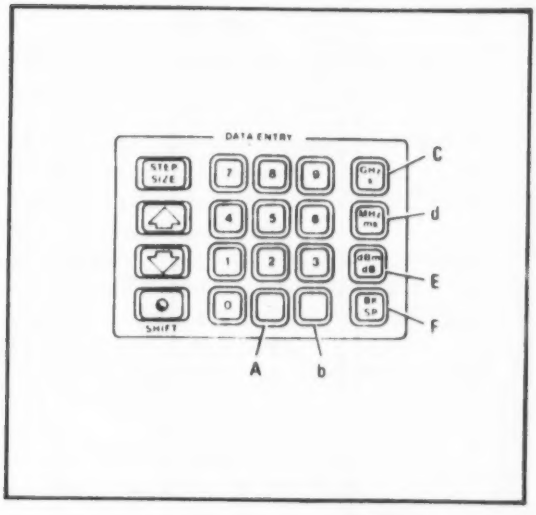

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Figure 4. Front panel hexadecimal entry keys.

(8) Press pushbuttons as listed in (a) through (h) below:

(a) M2.
(b) DATA ENTRY of 00.
(c) ↑.
(d) M2.
(e) DATA ENTRY of 40.
(f) ↑.
(g) M2.
(h) DATA ENTRY of 00.

(9) Record digital voltmeter indication.

(10) Adjust A6R11 (fig. 3) for a digital voltmeter indication of -6.250 V dc.

(11) Press pushbuttons as listed in (a) through (e) below:

(a) M2.
(b) DATA ENTRY of FF.
(c) ↓.
(d) M2.
(e) DATA ENTRY of 4F.

(12) Adjust A6R30 (fig. 3) for a difference of 12.9968 V dc between the value recorded in (9) above and indication on digital voltmeter.

(13) Press M2 and DATA ENTRY pushbuttons for OF.

(14) Adjust A6R25 (fig. 3) for a digital voltmeter indication of -12.6218.

(15) Press pushbuttons as listed in (a) through (e) below:

(a) M2.
(b) DATA ENTRY of CO.
(c) ↑.
(d) M2.
(e) DATA ENTRY of 00.

(16) Adjust A6R11 (fig. 3) for digital voltmeter indication of -19.5000 V dc.

(17) Repeat (6) through (16) above to verify -12.9968 until no further adjustments are necessary.

(18) Connect equipment as shown in figure 5.

(19) Press INSTR PRESET and CW pushbuttons.

(20) Record digital voltmeter indication.

(21) Press pushbuttons as listed in (a) through (c) below:

(a) CF.
(b) ΔF.
(c) DATA ENTRY for 0 MHz.

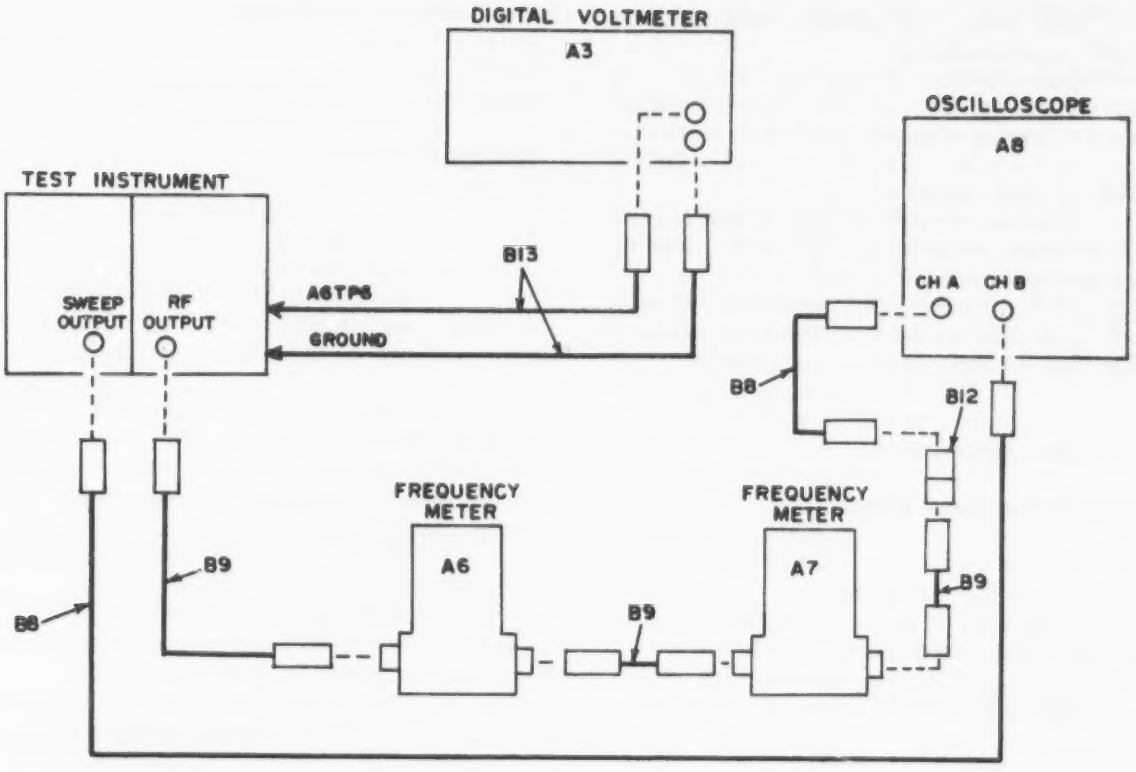

Figure 5. Delay compensation adjustment - equipment setup.

(22) Adjust A7R47 (fig. 3) on marker board to obtain the same reading recorded in (20) above.

(23) Disconnect digital voltmeter from setup.

(24) Press pushbuttons as listed in (a) through (y) below:

(a) INSTR PRESET.
(b) DATA ENTRY for 2.001 GHz.
(c) Frequency STOP.
(d) SWEEP TIME.
(e) DATA ENTRY for 10 ms.
(f) MKR M1.
(g) DATA ENTRY for 2.30 GHz.
(h) AMPTD MKR.
(i) RF BLANK.
(j) SAVE.
(k) DATA ENTRY, 2.
(l) SWEEP TIME.
(m) DATA ENTRY for 200 ms.
(n) SAVE.
(o) DATA ENTRY, 1.
(p) MKR M2.
(q) DATA ENTRY for 6.5 GHz.
(r) SAVE.
(s) DATA ENTRY, 3.
(t) SWEEP TIME.
(u) DATA ENTRY for 10 ms.
(v) SAVE.
(w) DATA ENTRY, 4.
(x) RECALL.
(y) DATA ENTRY, 1.

(25) Adjust frequency meter to obtain a pip on oscilloscope. Aline peak of pip with leading edge of 2.300 GHz marker.

(26) Press RECALL and DATA ENTRY 2 pushbuttons.

(27) Adjust A7R65 (fig. 3) until peak of pip is alined with leading edge of marker.

(28) Adjust TIME vernier control from 10 to 200 ms sweep. Pip will not vary more than ± 5 MHz on frequency meter.

(29) Press RECALL and DATA ENTRY 3 pushbuttons.

(30) Adjust frequency meter to obtain a pip on oscilloscope. Aline peak of pip with leading edge of 6.500 GHz marker.

(31) Press RECALL and DATA ENTRY 4 pushbuttons.

(32) Adjust A7R66 (fig. 3) until peak of frequency meter is alined with leading edge of marker.

(33) Adjust TIME vernier control from 10 to 200 ms sweep. Pip will not vary more than ±5 MHz on frequency meter.

14. Output Amplitude

a. Performance Check

NOTE

If any step of performance check is out-of-tolerance, perform **b** below.

(1) Connect power meter (A9) to RF OUTPUT and connect INPUT to power meter recorder out (rear panel), using attenuator and cable (B4 and B9).

(2) Press pushbuttons as listed in (a) through (f) below:

(a) INSTR PRESET.
(b) SWEEP TIME.
(c) DATA ENTRY for 100 s.
(d) DATA ENTRY for 13 dBm.
(e) SWEEP TRIGGER SINGLE.
(f) ALC MODE to MTR.

(3) Press SWEEP TRIGGER SINGLE pushbutton (SWP LIGHT will be on) while observing power meter peak to peak fluctuations. Power meter will not fluctuate more than ±.2 dB.

(4) Wait for SWP light to go out before continuing.

(5) Connect equipment as shown in figure 6, connection A.

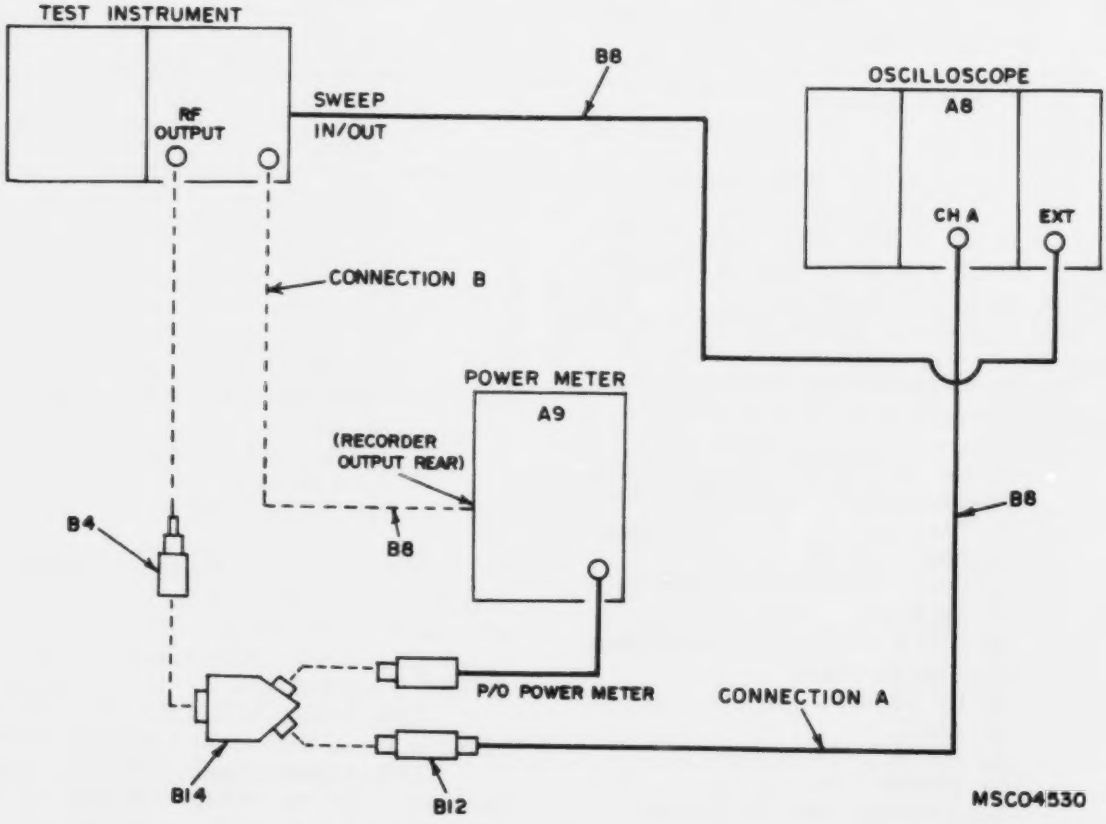

Figure 6. Output amplitude - equipment setup.

(6) Press pushbuttons as listed in (a) through (g) below:

(a) INSTR PRESET.
(b) SWEEP TIME.
(c) DATA ENTRY for 10 ms.
(d) SWEEP MODE SHIFT CW.
(e) ⌐¬ MOD.
(f) POWER LEVEL.
(g) DATA ENTRY for 11.5 dBm.

(7) Observe position of trace on oscilloscope (A8) and mark position with grease pencil on crt.

(8) Adjust power vernier control for an indication of 14.5 dBm on the TI power display.

(9) Observe position of trace on oscilloscope and mark position with grease pencil on crt.

(10) Make connection B also (fig. 5).

(11) Adjust power vernier control for an indication of 13 dBm on TI power display.

(12) Press START pushbuttons and observe oscilloscope, trace will be within upper and lower marks on crt.

(13) Press SHIFT and CW pushbuttons.

(14) Repeat technique of 6g through (13) above, using settings listed in table 5. Trace will be within upper and lower marks on crt.

Table 5. Output Amplitude Test

Test instrument indications (dBm)		
Range being tested	**Low limit**	**Upper limit**
+10	+8.5	+11.5
+5.0	+3.5	+6.5
±0.0	-1.5	+1.5
-2.0	-3.5	-0.5

b. Adjustments

(1) Connect equipment as shown in figure 7.

(2) Remove A5 FM driver board (fig. 3).

(3) Adjust A4R1 (fig. 3) fully ccw and press INSTR PRESET pushbutton.

(4) Isolate digital voltmeter (A3) from earth ground and connect positive lead to TP12 and negative lead to TP14 (fig 8), using two leads (B13).

(5) Adjust R47 (fig. 8) for digital voltmeter indication of 0.000 V.

(6) Attach jumper from TP11 (fig. 8) to ground and remove isolator, using adapter and lead (B11 and B13).

(7) Move digital voltmeter negative lead to TP5 (fig. 8).

(8) Adjust R56 (fig. 8) for digital voltmeter indication of 0.000 V (remove jumper).

(9) Isolate digital voltmeter from earth ground and connect positive lead to TP15 and negative lead to TP12 (fig. 8).

(10) Adjust R59 (fig. 8) for a digital voltmeter indication of -2 mV.

(11) Press CW pushbutton and observe that power level indicator light is off.

(12) Move digital voltmeter positive lead to TP7 (fig. 8).

(13) Adjust R67 (fig. 8) for digital voltmeter indication of 0.000 V.

(14) Press pushbuttons as listed in (a) through (c) below:

(a) CW.
(b) DATA ENTRY for 50 MHz.
(c) RF power to off.

(15) Move digital voltmeter positive lead to TP10 (fig. 8).

(16) Adjust A4R4 (fig. 3) for digital voltmeter indication of 0.000 V, and press RF pushbutton to ON.

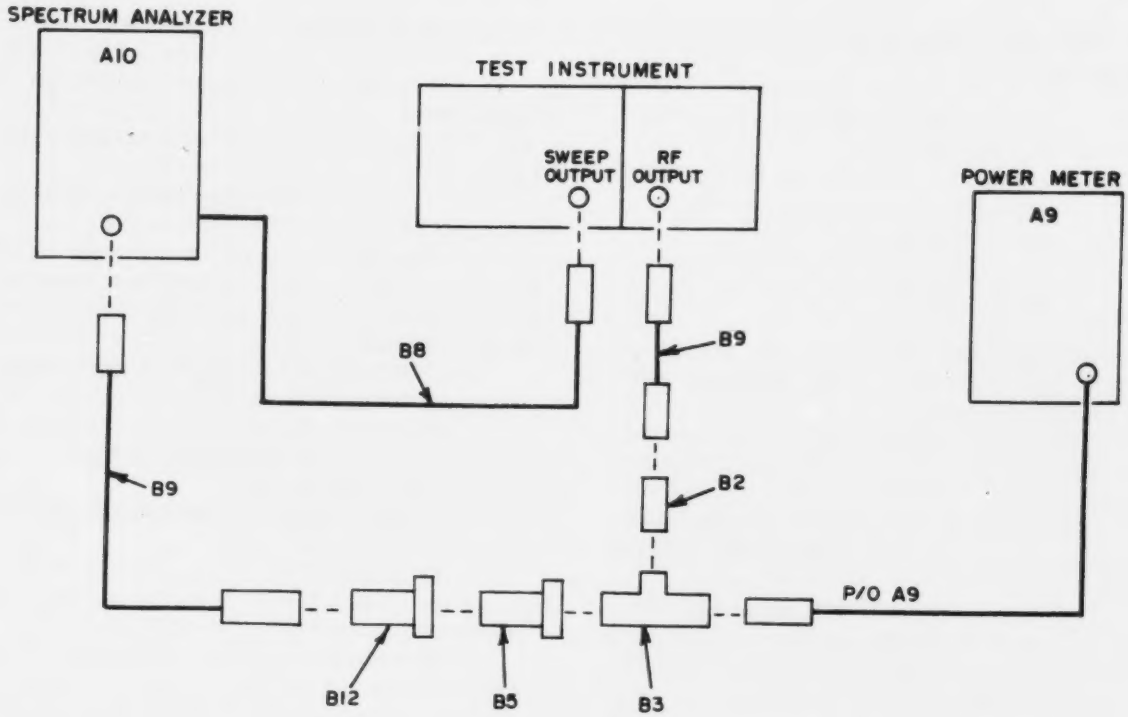

Figure 7. ALC - equipment setup.

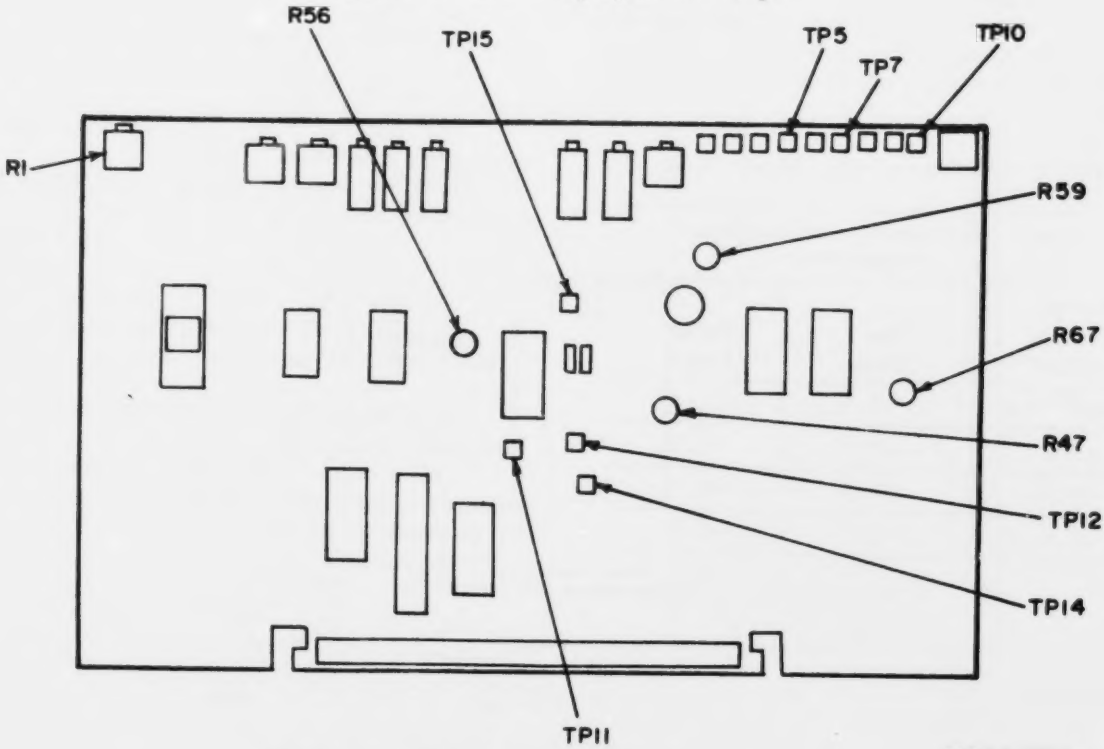

Figure 8. ALC - adjustment locations.

(17) Disconnect digital voltmeter and cables.

(18) Press POWER LEVEL and DATA ENTRY pushbuttons for +0-dBm indication on POWER display.

(19) Adjust A4R6 (fig. 3) for power meter indication of 0 dBm.

(20) Press POWER LEVEL and DATA ENTRY pushbuttons for +9 dBm on POWER display.

(21) Adjust A4R7 (fig. 3) for a power meter indication of +9 dBm.

(22) Press POWER LEVEL and DATA ENTRY pushbuttons for +13 dBm on POWER display.

(23) Adjust A4R2 (fig. 3) for power meter indication of +13 dBm.

(24) Disconnect power meter and adapter (B3) from equipment setup.

(25) Press pushbuttons as listed in (a) through (g) below:

(a) INSTR PRESET.
(b) ⌐ MOD.
(c) POWER LEVEL.
(d) DATA ENTRY for 0 dBm.
(e) RF BLANK.
(f) SAVE.
(g) DATA ENTRY ....1.

(26) Adjust A4R1 (fig. 3) for best overall flatness from 10 MHz to 2.2 GHz on spectrum analyzer.

(27) Adjust A4R5 (fig. 3) for trace continuity at band switch point.

(28) Press pushbuttons as listed in (a) through (d) below:

(a) POWER LEVEL.
(b) DATA ENTRY for +9 dBm.
(c) SAVE.
(d) DATA ENTRY ....2.

(29) Adjust A4R8 (fig. 3) for best trace continuity at band switch point on spectrum analyzer.

(30) Press pushbuttons as listed in (a) through (d) below:

(a) POWER LEVEL.
(b) DATA ENTRY for +13 dBm.
(c) SAVE.
(d) DATA ENTRY ....3.

(31) Adjust A4R3 (fig. 3) for best trace continuity on spectrum analyzer.

(32) Press pushbuttons as listed in (a) through (g) below:

(a) INSTR PRESET.
(b) START.
(c) DATA ENTRY for 2 GHz.
(d) STOP.
(e) DATA ENTRY for 8.4 GHz.
(f) ⌐ MOD.
(g) RF BLANK.

(33) Adjust spectrum analyzer to observe second harmonics of 2 to 4 GHz swept signal.

NOTE

Make adjustments in order in which they are written.

(34) Adjust R2, R8, R10, R12, on A13A1 board and A12A1R4 (fig. 9) for optimum harmonic levels on spectrum analyzer (at least 20 dB below the fundamental).

(35) Repeat technique of (33) and (34) above for 3 and 4 GHz swept signal.

(36) Repeat technique of (33) and (34) above for 4 and 6 GHz swept signal.

(37) Press pushbuttons as listed in (a) through (h) below:

(a) INSTR PRESET.
(b) START.
(c) DATA ENTRY for 10 MHz.
(d) STOP.
(e) DATA ENTRY for 8.4 GHz.
(f) ⌐ MOD.
(g) POWER LEVEL.
(h) DATA ENTRY for 0 dBm.

(38) Adjust A4R5 (fig. 3) for best trace continuity at 2.05 GHz on spectrum analyzer.

(39) Repeat technique of (38) above for +9 dBm, adjusting A4R8 (fig. 3) and +13 dBm, adjusting A4R3 (fig. 3).

(40) Reinstall A5 FM driver board.

(41) Press POWER LEVEL and DATA ENTRY pushbuttons for +9 dBm on the POWER display.

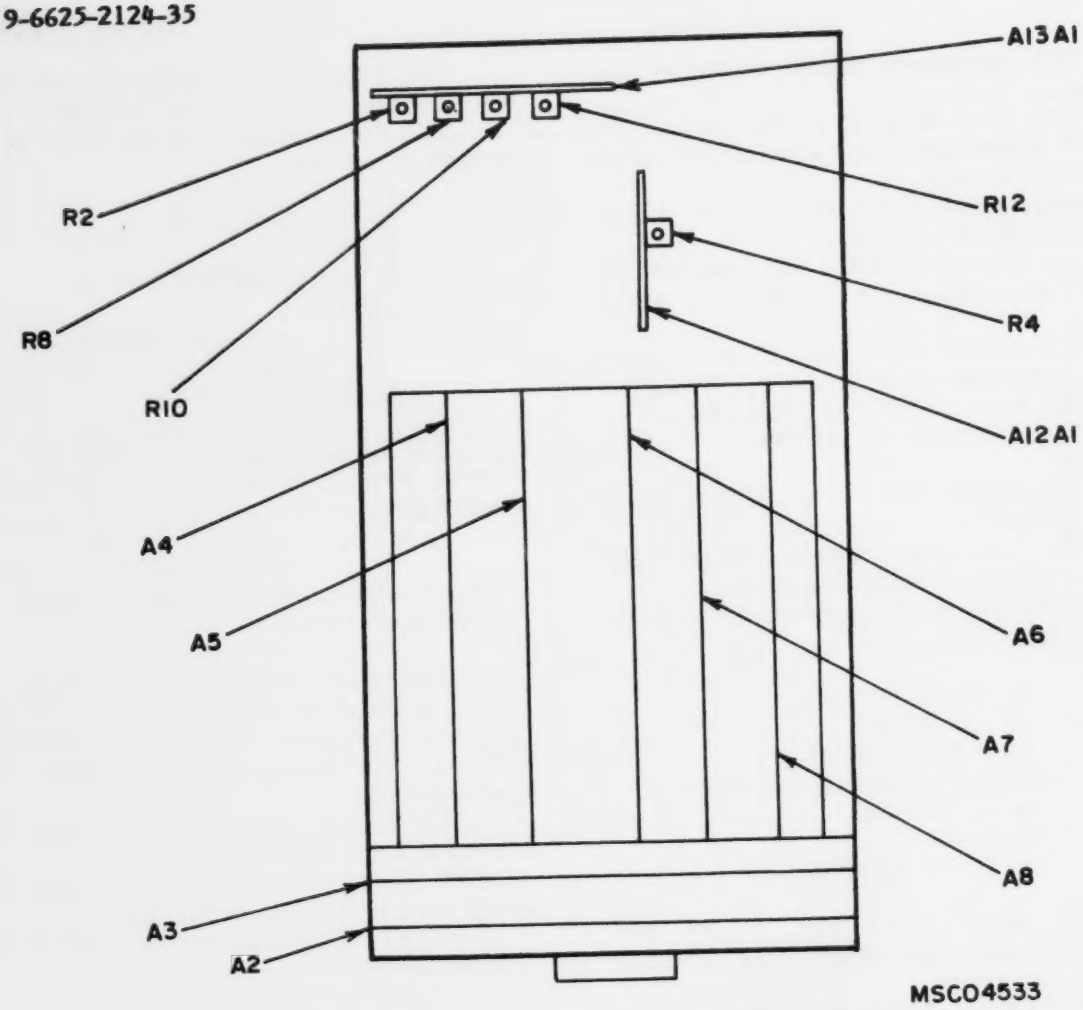

Figure 9. Band 1 harmonics - adjustment locations.

(42) Adjust A5R48, A5R34, A5R36, A5R38, A5R40, A5R41, A5R42, A5R43, and A5R44 (fig. 3) for best overall flatness on spectrum analyzer.

(43) Observe full band, from .01 MHz to 8.4 GHz on spectrum analyzer and select a band 0 frequency where power level is approximately in the middle from highest amplitude to lowest amplitude.

(44) Press pushbutton as listed in (a) through (d) below:

(a) CW.
(b) DATA ENTRY for band 0 frequency (as selected in (43) above).
(c) POWER LEVEL.
(d) DATA ENTRY for 0 dBm.

NOTE

If the following steps result in A4R6 and A4R7 being adjusted near the stops, connect digital voltmeter (A3) low to A4TP15 (fig. 8) (floating ground) and connect digital voltmeter high to A4TP12, using leads (B13) and adjust A4R59 for -2 MV $\pm$ 0.1 mV.

(45) Remove spectrum analyzer from attenuator and connect power meter to attenuator.

(46) Press pushbuttons as listed in (a) through (c) below:

(a) ⎍ MOD.
(b) POWER LEVEL.
(c) DATA ENTRY for + 0 dBm.

(47) Adjust A4R6 (fig. 3) for an indication of + 0 dBm on power meter.

(48) Set POWER LEVEL first to -2 dBm, record power meter indication, then set POWER LEVEL to +2 dBm and record power meter indication. Deviation from 0 dBm should be equal in value and opposite in sine; if not, readjust A4R6.

(49) Press POWER LEVEL and DATA ENTRY pushbuttons for +9 dBm on POWER display.

(50) Adjust A4R7 (fig. 3) for an indication of +9 dBm on power meter.

(51) Repeat (46) through (50) above to verify readings.

(52) Press POWER LEVEL and DATA ENTRY pushbuttons for +13 dBm on POWER display.

(53) Adjust A4R2 (fig. 3) for an indication of +13 dBm on POWER display.

(54) Disconnect power meter from attenuator and connect spectrum analyzer to attenuator.

(55) Press pushbuttons as listed in (a) through (h) below:

(a) INSTR PRESET.
(b) START.
(c) DATA ENTRY for .01 MHz.
(d) STOP.
(e) DATA ENTRY for 8.4 GHz.
(f) ⌐ MOD.
(g) POWER LEVEL.
(h) DATA ENTRY for -2 dBm.

(56) Adjust A4R11 (fig. 3) to increase gain of main ALC amplifier until oscillation begins to occur, then reduce gain just enough to eliminate oscillations.

(57) Observe sweep full range and adjust A4R11 (fig. 3) whenever oscillation is noted (as shown in fig. 10).

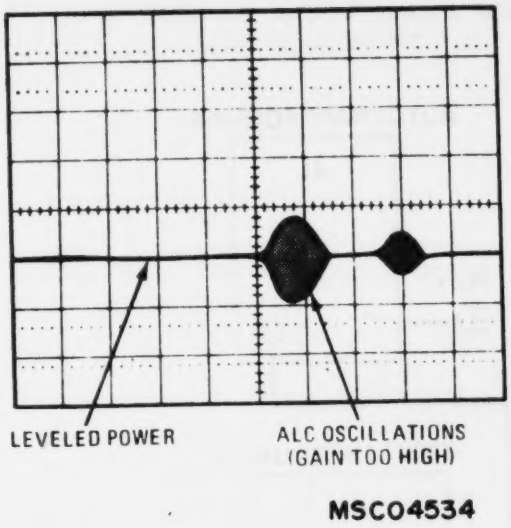

Figure 10. Leveled power trace showing ALC oscillations.

15. Frequency Stability

a. Performance Check

(1) Connect equipment as shown in figure 11.

(2) Press pushbuttons as listed in (a) through (c) below:

(a) INSTR PRESET.
(b) CW.
(c) DATA ENTRY for 1.0 GHz.

(3) Adjust autotransformer (A1) to 115 V ac and record frequency counter (A5) indication.

(4) Vary autotransformer from 108 to 126 V ac. Frequency counter indication will not vary more than ± 20 kHz.

(5) Readjust autotransformer to 115 V ac.

b. Adjustments. No adjustments can be made.

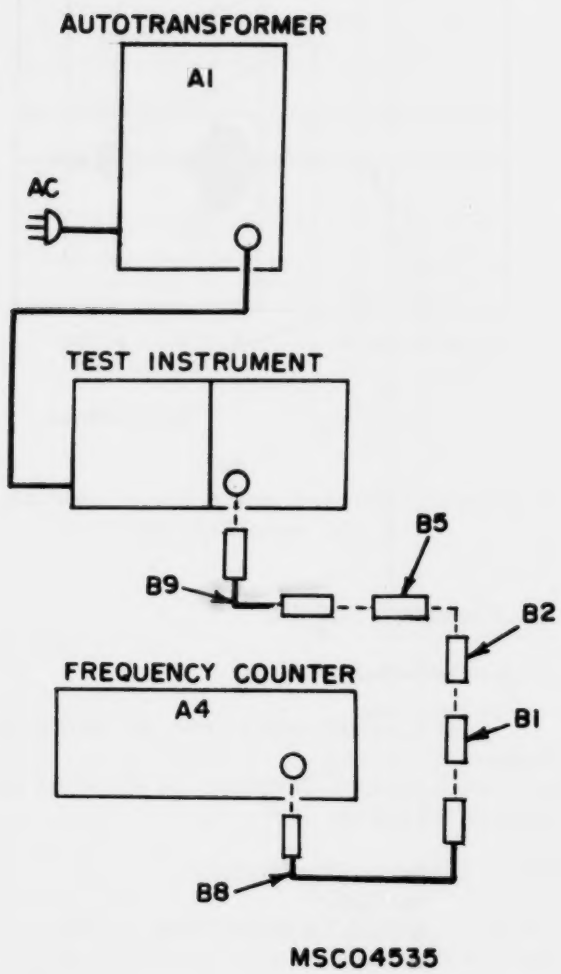

Figure 11. Frequency stability - equipment setup.

16. AM On/Off Ratio and Square Wave Symmetry

a. Performance Check

(1) Connect spectrum analyzer (A10) to RF OUTPUT, using attenuator and cable (B4 and B9).

(2) Press pushbuttons as listed in (a) through (f) below:

(a) INSTR PRESET.
(b) CW.
(c) DATA ENTRY for 1 GHz.
(d) ⎍ MOD.
(e) POWER LEVEL.
(f) DATA ENTRY for 13 dBm.

(3) Adjust spectrum analyzer REFERENCE LEVEL control to position trace on top of crt. AM ON/OFF ratio indication will be more than 30 dB and trace symmetry will be 40/60 percent.

(4) Press CW and DATA ENTRY pushbutton controls for a 4-GHz indication on FREQUENCY display.

(6) Repeat technique of (3) and (4) above. AM ON/OFF ratio will be more than 30 dB and trace symmetry will be 40/60 percent.

b. Adjustments. No adjustments can be made.

17. Final Procedure

a. Deenergize and disconnect all equipment and reinstall protective cover on TI.

b. When all parameters are within tolerance, annotate and affix DA Label 80 (US Army Calibrated Instrument). When the TI receives limited or special calibration, annotate and affix DA Label 163 (US Army Limited or Special Calibration). When the TI cannot be adjusted within tolerance, repair the TI in accordance with the maintenance manual. When repair is delayed for any reason or the TI cannot be repaired with local resources, annotate and affix DA Form 2417 (US Army Calibration System Rejected Instrument) and inform the owner/user accordingly in accordance with TB 750-25-1.

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